Next Generation Internet Program Update--Department of Energy

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DOE Involvement in NGI

- Year 1 (FY98)
  - Congress eliminates DOE funding for NGI
- Year 2 (FY99)
  - Congressional Energy & Water Appropriations Committee eliminates DOE funding for NGI
  - Omnibus Spending Bill allocates $15M
- Year 3 (FY00)
  - Congress eliminates DOE funding for NGI

Original DOE NGI Milestones

- **Year 1 - FY98**
  - **Generate Solicitation notice**
  - **Develop 100X testbed infrastructure**
  - **Develop low level tools to monitor/verify testbed operation**
  - **Start development of middleware services**
  - **Start development of Scientific Applications**

Original DOE NGI Milestones

- Year 2 - FY99
  - Develop API's and tools for QoS services
  - Develop security tools and services
  - Deploy QoS services in testbed
  - Integrate Middleware with network tools and services

Original DOE NGI Milestones

- **Year 3 - FY00**
  - **Integrate Applications with Middleware**
  - **Deploy middleware services in testbed**
  - **Demonstrate scientific application over testbed**

Modified DOE NGI Milestones

- Year 1 - FY98
  - No funding provided for participation in NGI
- Year 2 - FY99
  - Generate Solicitation notice (completed)
  - Develop 100X testbed infrastructure*
  - Develop low-level tools to verify/monitor testbed operation*
  - Start development of advanced QoS services
  - Start development of Scientific Applications*

* Will be completed in FY00

Modified DOE NGI Milestones

- Year 3 - FY00 (Program is Terminated, some accomplishments will occur using resources provided from FY99 funds)
  - Develop API's and tools for QoS services*
  - Develop security tools and services
  - Deploy QoS services in testbed*
  - Integrate Middleware with network tools and services

  * Will be completed in FY00

Modified DOE NGI Milestones

- Year 4 - FY01 (Program Terminated, no further work authorized)
- Year 5 - FY02 (Program Terminated, no further work authorized)

DOE FY99 NGI Solicitations

- 99-08 -- Research in Basic Technologies
  - 12 projects funded
- 99-09 -- Applications-Network Technology-Network Testbed Partnerships
  - 5 projects funded
- 99-10 -- DOE-University Technology Testbeds
  - 3 projects funded
- Awards to 16 Universities and 9 Labs in 14 States

DOE NGI Program Awards

Research in Basic Technologies

Twelve projects, for developing advanced middleware services, advanced network architectures and components, and advanced network monitoring tools and services.

- Architecture ***- Univ. of Tenn; USC***
- Hardware ***- GATech; LANL***
- Integration and Analysis ***- USC/ISI, LBLN; UCSD***
- Measurements ***- UIUC, ANL; UKan, LBNL***
- Middleware ***- USC/ISI, ANL, Univ of Wisc; NIU, ANL***
- Visualization ***- Ohio State; LBNL***

DOE NGI Program Awards

Applications-Network Technology-Network Testbed Partnerships

Five applications, all collaborations with multiple sites that include universities and national laboratories

- *A Grid-based Collaboratory for Real-time Data Acquisition, Reduction and Visualization for Macromolecular X-Ray Crystallography Using the LBL Advanced Light Source* ***- Indiana Univ and ANL***
- *CorridorOne: An Integrated Distance Visualization Environments for SSI and ASCI Applications* ***- ANL, LBNL, LANL, UIC, Univ of Utah, and Princeton Univ***
- *Prototyping an Earth System Grid* ***- UCAR, USC, Univ of Wisc, ANL, LANL, LBNL, and LLNL***
- *Prototyping a Combustion Corridor* ***-LBNL, ANL, LANL, Univ of Wisc***
- *The Particle Physics Data Grid* ***- Caltech, SDSC, USC, ANL, BNL, FNAL, Jlab, LBNL, and SLAC***

DOE NGI Program Awards

DOE-University Technology Testbeds

Three testbeds, for demonstrating advanced services to university sites, improving capabilities and access for university researchers involved in applications including combustion, climate, and high-energy physics

- *EMERGE: ESnet/Metropolitan Research and Education Network (MREN) Regional Grid Experimental NGI Testbed -* ***Univ. of IL-Chicago, Univ. of IL-Urbana-Champaign, Northwestern Univ., Univ. of Wisc., Univ. of Chicago***
- *QUALIT: QBone University and Lab Interconnect Testbed (a collaborative testbed project with the Internet2 QoS Working Group)-* ***University Corporation for Advanced Internet Development***
- *ESnet: An advanced testbed infrastructure for DOE collaboratories -* ***ANL, LBNL, LANL, FNAL, Jlab, SLAC, Sandia, BNL, LLNL***

Geographic Listing of NGI sites by State

State	Basic R&D	Testbed	Application
California	3	6	6
Colorado	0	1	1
Georgia	1	0	0
Illinois	3	6	3
Indiana	0	1	1
Kansas	1	0	0
New Jersey	0	1	1

Geographic Listing of NGI sites by State

State	Basic R&D	Testbed	Application
New Mexico	1	1	1
New York	0	1	1
Ohio	1	0	0
Tennessee	1	0	0
Utah	0	1	1
Virginia	0	1	1
Wisconsin	1	1	1

Significant Achievements

- Application level QoS support using Diff-Serv demonstrated
- QoS testbed infrastructure expanded to University partners
- Netlogger tool enables Distributed Application Team to transfer data at
  71 MBps (570 Mbps)

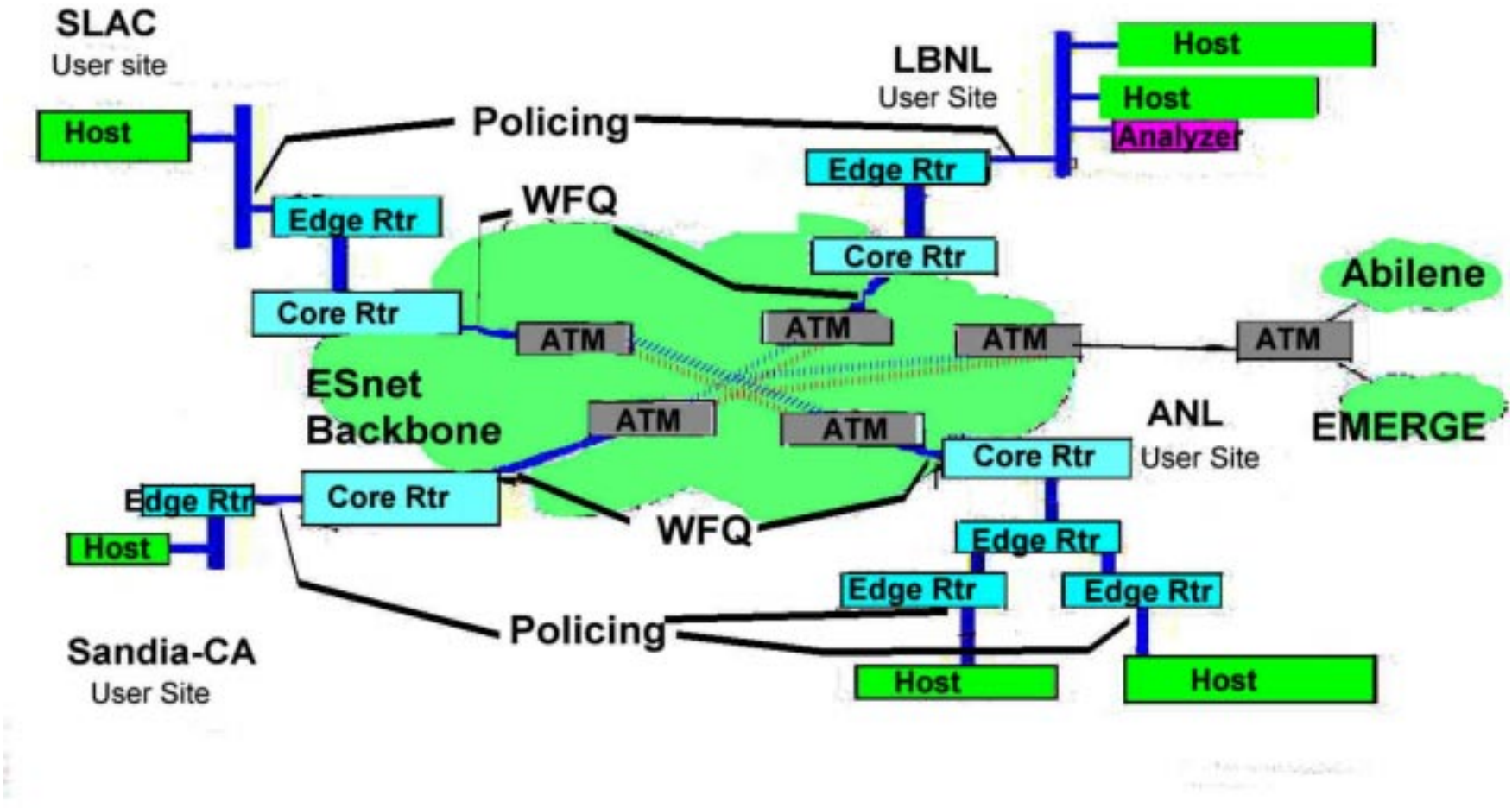
NGI Testbed Awards Have Enabled Significant Progress

- **ESnet**
  - Deployed QoS capable routers at 4 Laboratories
  - Deployed QoS resource manager
  - Deployed API's in QoS capable hosts
  - Completed QoS testing between sites
    - Applications able to communicate with RM
    - RM able to configure router to mark/forward packets
  - Successfully completed QoS demos at SC'99

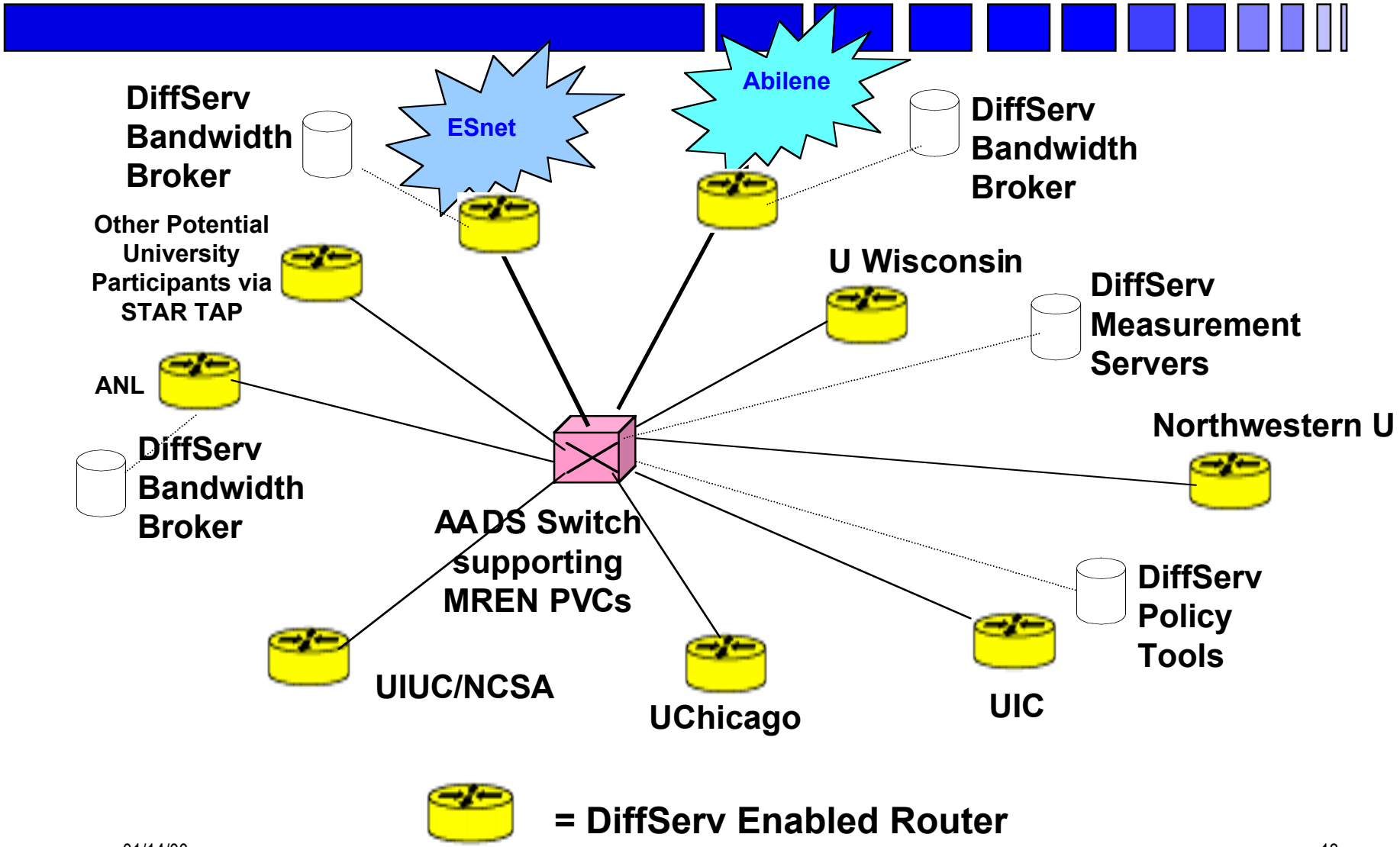
- **EMERGE**
  - Deployed QoS capable routers at 5 Universities
  - Deployed QoS capable router at Ameritech NAP
  - Established basic IP connectivity between sites
  - Deployed QoS resource manager
  - Completed initial QoS testing between ANL and Northern Illinois University
  - Joint I2/DOE workshop on QoS

ESnet/MREN Regional Grid Experimental NGI Testbed (EMERGE)

ESnet QoS Testbed



DOE NGI EMERGE Testbed



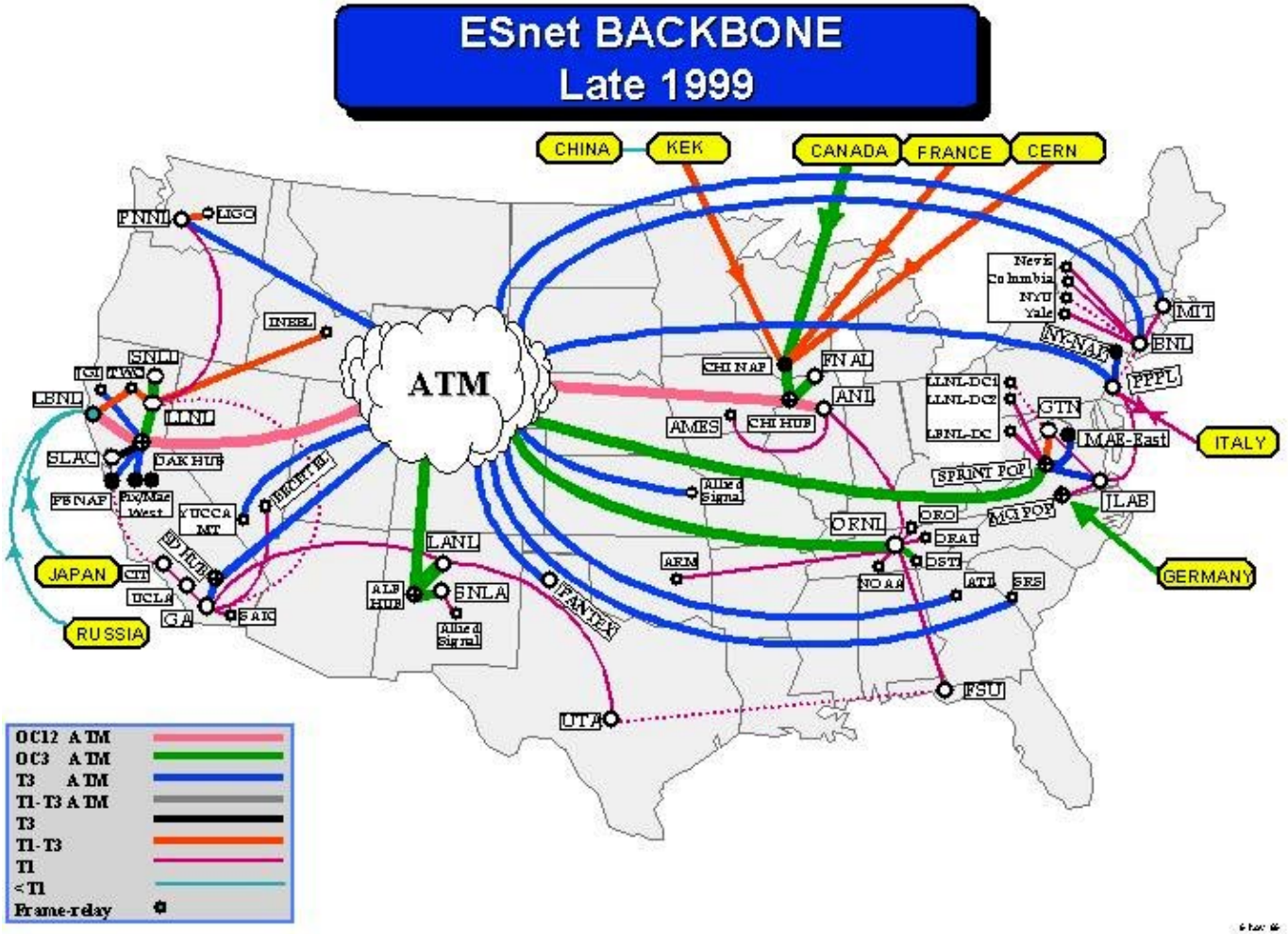
Lessons Learned

- Vertical integration effort required
  - End Users, Application programmers, Middleware developers, Network engineers, and Operations staffs
- All communities must be involved in the planning
  - FedEx vs Real-Time QoS
- Security and Performance issues will conflict
  - Measuring performance of an ISP router
- Tuning required to obtain maximum performance
  - Application and Network

Conclusions

- DOE NGI program terminated due to lack of congressional support
- Individual projects will terminate as work cycle ends
- Even with one year funding the DOE NGI program will make significant contribution to the NGI effort

ESnet Network Map



EMERGE Testbed Plans

ESnet/MREN Regional Grid Experimental NGI Testbed

- **Site/edge routers will mark Premium Service flows** (Cisco IOS rsp-pv-mz.120-5.XE2)
- **Sites will ensure Premium Service to end systems**
- **ESnet & Abilene routers will police at ingress**
- **ESnet & Abilene will set per hop behavior (PHB) as needed**
- **Goal: to ease manual configuration burden**
- **Goal: persistent testbed infrastructure**

EMERGE Testbed Status

- ANL up; Globus/GARA up
- NWU router up; Globus/GARA up
- UIC router in
- STAR TAP router up
- UIUC/NCSA router in;
- UOC router in
- WISCONSIN router in